BIOMAGNETISM
CLINICAL ASPECTS

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Biomagnetism: Clinical Aspects

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Preface

This volume comprises papers presented at the 8th International Conference on Biomagnetism, held from 18 to 24th August 1991, at the University of Münster, Germany, and attended by approximately 400 participants from more than 30 countries. A total of 240 invited lectures and contributed papers (including posters) were presented, but only a selection of 142 manuscripts are included in this volume. This change in the publication policy of the proceedings became necessary because of a physical limit imposed by the size of the book (there were about 80 contributions in Vancouver, 170 in Tokyo, 185 in New York). This issue was exhaustively discussed at the preceding conference in New York, and the majority of participants agreed that future proceedings should be restricted to a selection preferably of those papers which were directly related to the main subject of the conference.

The New York Conference celebrated the 20th anniversary of the first application of a SQUID (Superconducting QUantum Interference Device) to biomagnetism. The year of the Münster Conference was also characterized by the coincidence of several anniversaries with some significance for biomagnetism. Two hundred years earlier, in 1791, the Italian scientist Luigi Galvani discovered what he believed to be "animal electricity" (only a few years after Franz Anton Mesmer postulated the existence of an "animal magnetism")[1]. One-hundred-and-twenty years later, in 1911, the Dutch physicist Heike Kamerlingh Onnes discovered superconductivity, one of the essential prerequisites for measuring the extremely weak biomagnetic signals. Last, but not least, 15 years before the Münster conference, in 1976, the first meeting of this series took place in Boston, Massachusetts, then being more a forum for discussion rather than a formal conference.

Biomagnetic research had started well before this first conference. Its year of birth can be dated back to 1963 when Baule and McFee succeeded in measuring real "animal" magnetism, the magnetocardiogram. With the passing of almost three decades since then, the new emerging discipline of biomagnetism has undergone a remarkable development. Originally, biomagnetic research was confined to laboratories belonging to physical or engineering sciences, basically owing to the fact that the necessary equipment was not yet on the market. This situation changed drastically when SQUID systems for biomagnetic studies became commercially available. Biomagnetic research then began to spread out to biosciences. The proceedings of the two previous conferences with their increasing portion of papers related especially to neuromagnetism and to cardiomagnetism, and also to other aspects of biomagnetic applications e.g. biosusceptometry, bear eloquent witness of this de-

[1]Interestingly enough, both were wrong with their ideas. Mesmer's magnetism existed only in his imagination, while Galvani's electricity was produced solely by his instrument acting as a local element.

velopment. Biomagnetic research in a clinical environment, however, could not flourish before another obstacle was overcome: Data collection as it was originally done with single-channel systems was not only too laborious, it was often unacceptable for the patient, and many phenomena – especially spontaneous activity – could not be adequately studied. The advent of multi-channel (24–37) systems, which became available just prior to the New York Conference, signifies a quantum jump for the biomagnetic research in clinical environments.

Hence, at the 8th Conference on Biomagnetism, it was consistent to put the emphasis on clinical aspects. There are certainly more reasons for emphasizing clinical research, reasons which are, in part, closely interrelated. Powerful biomagnetic equipment is extremely expensive, and the price is actually higher than that of MRI and PET instruments. While, for those instruments, clear-cut clinical applications exist which are recognized and paid for by health insurance funds, no clear-cut clinical applications exist so far for biomagnetism. It was the aim of the Scientific Committee to take stock of the actual clinical research in biomagnetism in order to see whether clinical applications can be foreseen in the near future. Only if clinical applications of biomedical techniques can be developed which are superior to, and cannot be replaced by, other available techniques, then there are chances that development and improvement of biomagnetic systems will further continue and that a substantial price reduction can be achieved. Further development as well as a substantial price reduction of biomagnetic systems, on the other hand, are prerequisites for their widespread use.

This is, therefore, a decisive time for the future of biomagnetism. As already mentioned, further development and improvement of systems for biomagnetic research is necessary to achieve another quantum jump from a scientific instrument to a powerful and irreplaceable clinical tool. Many steps are needed to achieve this quantum jump, including the development of systems covering the whole head[2] or whole chest, and developments allowing the reduction of costs for purchase and maintenance of these systems. The development of low-noise High-Tc SQUIDs[3] would be one possible step in this direction.

The majority of papers presented at this conference were devoted to neuromagnetism, cardiomagnetism and biosusceptometry. It is noteworthy that promising research has also begun in other medical disciplines, especially in gastroenterology. However, the conference also revealed that the big step forward has not yet been made. The time has not come yet for widespread clinical applications of biomagnetic techniques. More than developments in instrumentation are required for establishing clinical applications, and models for the interpretation of data play a crucial role. It is the greatest challenge for biomagnetic research to develop strategies which produce confident findings on which a diagnostic or therapeutic decision can be based.

[2]The first whole-head system became operative just prior to the appearance of this volume.
[3]Also the first reports about successful applications of High-Tc SQUIDs for neuromagnetic and cardiomagnetic measurements have just appeared.

These comments, however, do not at all imply that biomagnetism has no future. The superiority of biomagnetic (like bioelectric) techniques – as compared with imaging techniques like MRI and PET – lies in its unequalled temporal resolution, though the lead has become distinctly smaller. Information obtained from echo planar imaging (which requires no more than 25 ms for one slice) could be extremely helpful for the development of reliable source models for biomagnetic localization.

A conference of 400 participants can be successful only by virtue of dedicated collaboration of many individuals. A significant contribution to the success of the conference was made by the members of the Scientific Committee by reviewing the submitted abstracts. We also wish to thank all members of the Organizing Committee and the members of the Institute of Experimental Audiology of the University of Münster for their tireless efforts before and during the conference. Georg Kämmerer deserves special acknowledgement for editing the submitted manuscript files, of which many were unreadable. Finally, a conference like this could not be organized without the substantial support of sponsors and exhibitors, whose substantial contributions are gratefully acknowledged.

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